Agricultural Efficient Water Management Practices That Stretch California's Water Supply

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Governor
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Secretary for Resources
The Resources Agency

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Director
Department of Water Resources

Foreword

California farmers continue to improve the effectiveness of water application each year by managing irrigation systems more efficiently, implementing irrigation scheduling, and by adopting new technologies.

This publication explains some of the efficient water management practices growers and irrigation/water districts implement to sustain water supply savings; improve water use and irrigation efficiency; enhance fish and wildlife habitats; improve ground water quality; and reduce agricultural drainage volume.

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Table of Contents

Foreword iii

Organization vii

California Irrigation Management Information System 1

AGWATER 5

Mobile Irrigation Management Laboratories 7

Irrigation Training 11

Agricultural Drainage Reduction 13

Additional activities that are making the difference 17

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California Irrigation Management Information System (CIMIS)

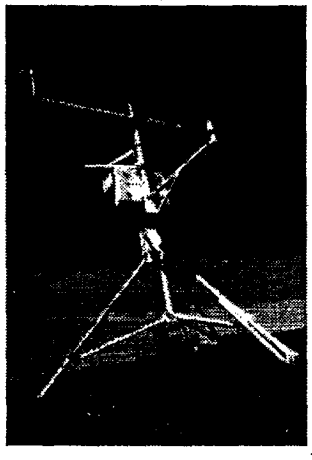
On-line access to local weather data

California farmers throughout the State are increasingly going on-line to use timely and quality data from CIMIS to help schedule irrigation events. Improving agricultural and landscape water use efficiency in a semi-arid area, such as California, requires knowing when and how much water to apply to crops. Improvements in agriculture and landscape irrigation has meant the difference between profit and loss to many irrigation managers. These improvements have also meant significant savings in water, energy, and capital outlay costs for water purveyors.

For many years, farmers have been using CIMIS to help take the guesswork out of irrigation. This integrated network of more than 85 computerized weather stations is located throughout California in many agricultural and municipal sites such as parks and golf courses.

Weather data are collected from each weather station and automatically transmitted each night by telephone to a central computer located in Sacramento. The data undergoe quality control and then are stored in the CIMIS data base to provide on demand information.

Based on actual field weather data, CIMIS estimates the amount of water evaporated from the soil and the amount used by irrigated pasture grass at the weather station site. This combined value for pasture grass is called reference evapotranspiration or "*ETo*."



Picture: A CIMIS weather station collects localized weather data that helps growers schedule their irrigations.

Many growers, irrigation consultants, and landscape water managers use CIMIS *ETo* rates to determine the amount of water used by selected crops. By using individual crop coefficients irrigation planners are able to accurately monitor crop water use and schedule water applications according to when the plant needs it and how much is required for optimum growth. Irrigation consultants who are available to assist CIMIS users are also listed on the network, per their request.

Good irrigation scheduling reduces the amount of applied water during a season and almost always improves water use efficiency. Farmers who use CIMIS usually improve growth performance of crops resulting in higher yields and better quality. All that is needed to access the CIMIS network database is a microcomputer, telephone modem, and communication software.

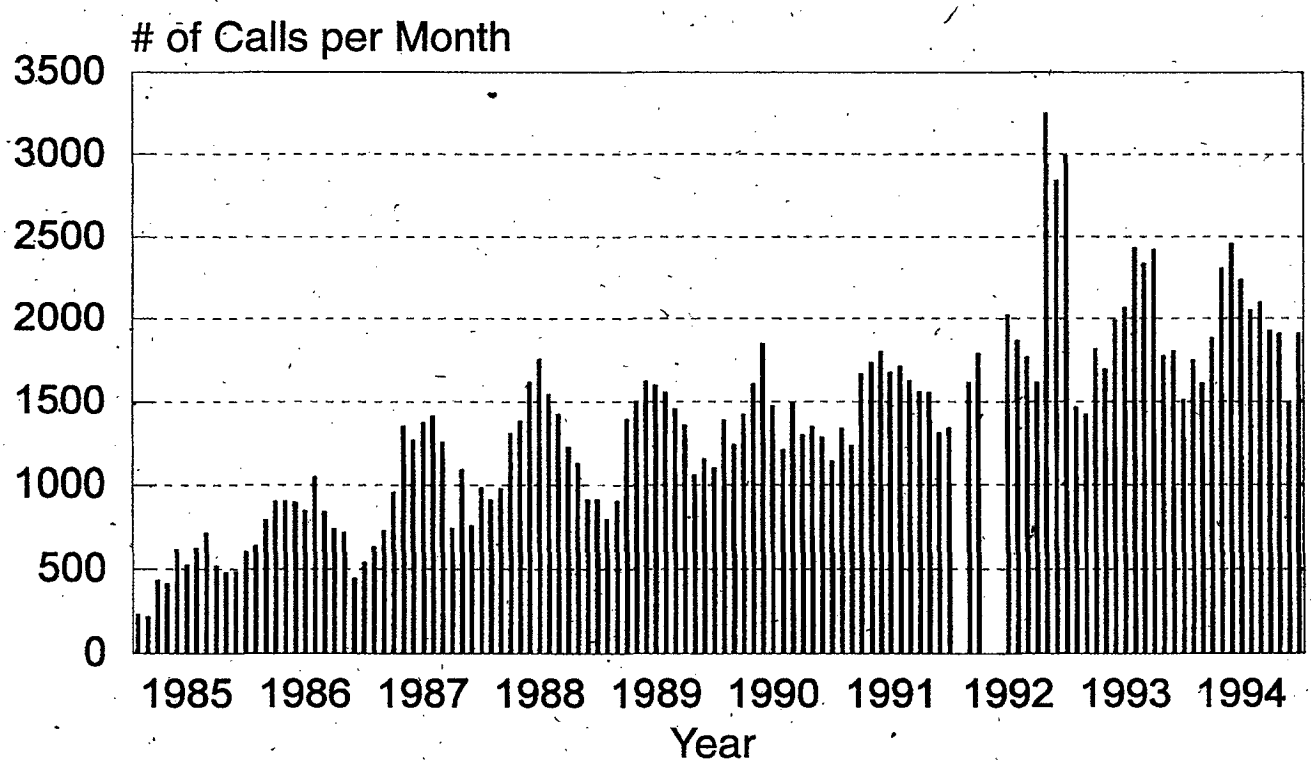
Over 2,000 direct users have access to CIMIS. CIMIS information is also available from local agencies, farm advisors, private consultants, newspapers, radio stations, telephone recordings, USDA/Natural Resources Conservation Service, and the National Weather Service's Agricultural Report. In 1993 and 1994, over 22,700 direct calls were made each year to the CIMIS computer alone. In addition, about 30,000 requests and inquiries were made indirectly to obtain the CIMIS data. CIMIS data are also available on the California State University Advance Technology Information Network, the University of California Integrated Pest Management computer at Davis, and the California Data Exchange Center Database computer.

Benefits of Using CIMIS

- Proper irrigation can increase yield.
- Proper irrigation can improve quality of yield.
- Efficient irrigation reduces drainage and conserves water, energy, and money.
- Irrigating at the right time and right amount reduces the costs of labor, pesticides, and fertilizers.
- Efficient irrigation can prevent contamination of surface and ground water.

California growers, landscape managers, and others are increasingly using CIMIS data and scheduling irrigations to optimize efficiencies, achieve high yields, and reduce costs.

CIMIS Computer Calls

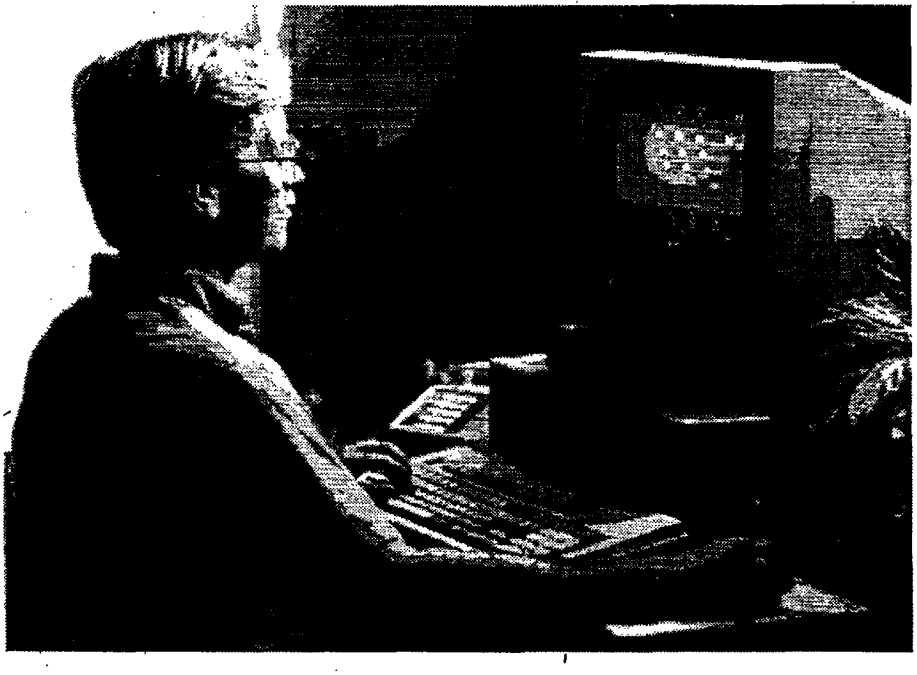


AGWATER

On-farm irrigation management computer software

Farmers in over 50 irrigation districts around the State now have access to AGWATER, a comprehensive, computer software program that performs individual irrigation diagnostic tests.

AGWATER combines the elements of soil science, plant water use, irrigation scheduling, irrigation system design, field geometry, and irrigation distribution uniformity. By answering a series of related questions, growers provide information about their field and the crop they are growing, and then analyze a typical year's irrigation, event-by-event. At each step of the program the grower may go back and modify previous answers to conduct a 'what if' scenario. After the information has been entered, AGWATER displays a graphic picture on the computer screen that simulates irrigations for the field throughout the season as well as an annual summary. Helpful tips are generated for improvements, and a normal year irrigation schedule is provided on demand.



Picture: A grower performs an irrigation diagnostic test with AGWATER—a computer software program.

AGWATER requires about two hours to run completely through a one-year irrigation program for a first-time user. Second-time runs can be done in about 15 minutes. Typically, a farmer will first run through an 'as is' scenario. Then, based upon the tips that are generated and the graphics displayed, the farmer goes back into the program. By making "what if" changes, in most cases, distribution uniformity and also seasonal irrigation efficiency will be increased, compared to the past year's results.

AGWATER was developed by the California Department of Water Resources and the Agricultural Engineering Department at the California Polytechnic State University, with financial assistance from Pacific Gas and Electric Company.

Five irrigation methods are analyzed with AGWATER:

- border strip
- hand move/side roll sprinkler
- permanent under-tree sprinklers
- micro-irrigation (both drip and spray)
- furrow

Additional softwares to assist with irrigation management are available from the private sector.

Mobile Irrigation Management Laboratories—The Mobile Labs

Promotes efficient on-farm irrigation practices

Mobile Irrigation Management Laboratories, known as Mobile Labs, are used by farmers wanting to evaluate the efficiency and uniformity of their irrigation systems and to determine how to improve their irrigation system and management. Each lab consists of a qualified irrigation expert, one assistant, and a vehicle loaded with the necessary equipment to take field measurements.

Since 1982, over 2,500 farmers statewide have requested and received irrigation system evaluations from Mobile Labs. Currently, about 60 water agencies in California are cost-sharing nine Mobile Labs to a tune of over 80 percent of total program funds. In addition, USDA/Natural Resources Conservation Service contributes in kind services to this program.

Picture: A mobile lab irrigation expert calculates field measurements of irrigation efficiency.

An irrigation system evaluation:

- Measures all the possible variables affecting the amount of water received by plants across a particular field.
- Computes the distribution uniformity of a single irrigation event.
- Computes potential seasonal irrigation efficiency.
- Provides a one-page printout summarizing the possible water and dollar savings to the farmer.

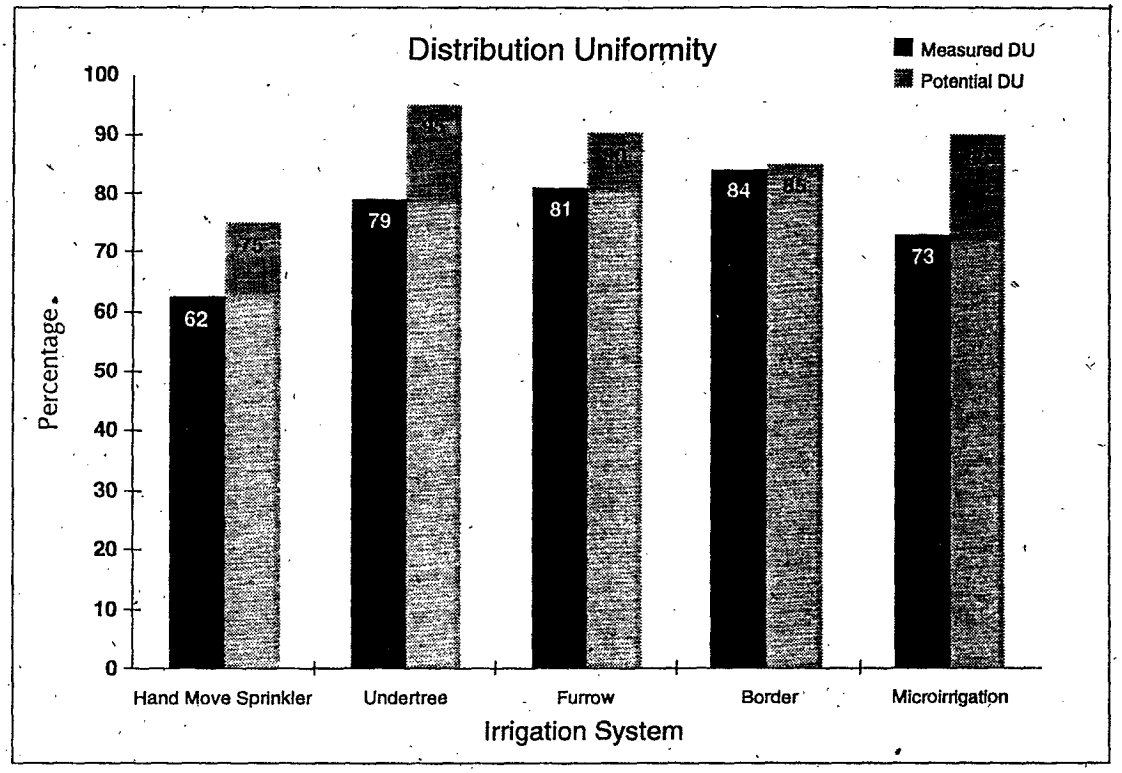
Farmers can use these steps to prioritize the management or maintenance changes that are recommended by identifying which problems, when corrected, give the greatest return.

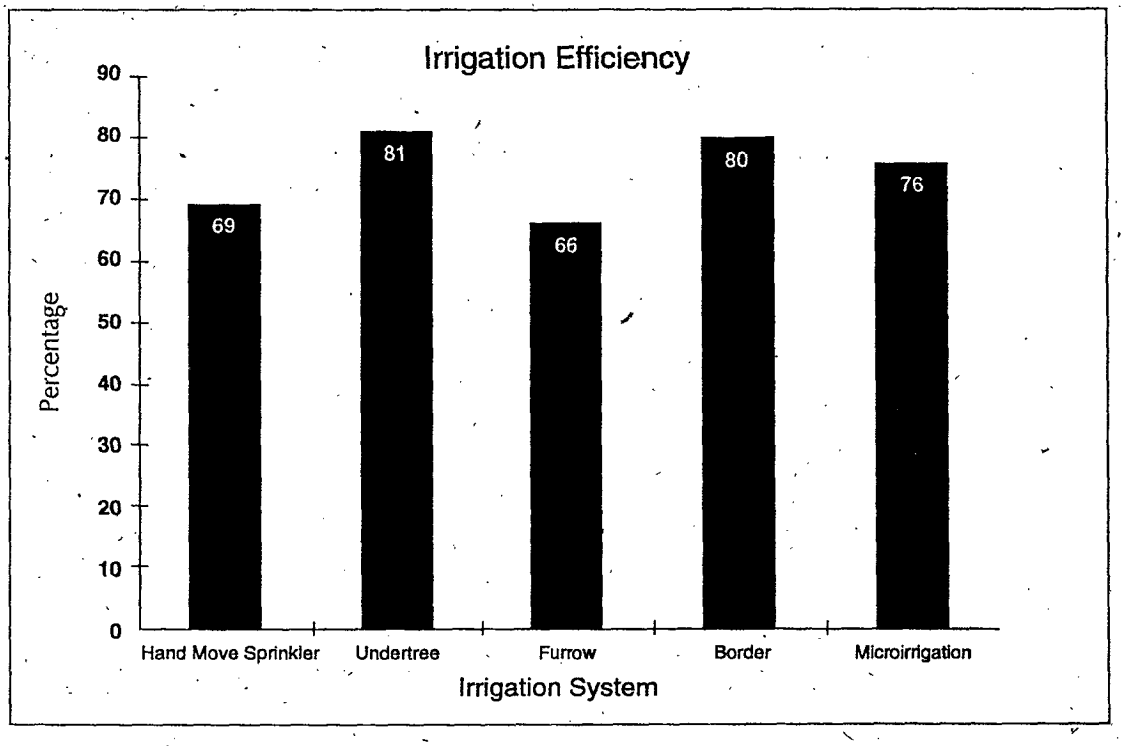
Some of the Typical Mobile Lab Recommendations are:

- Replace worn nozzles in sprinklers.
- Use pressure regulators, when needed.
- Use media filters (sand) in drip.
- Prevent large pressure variation in pressurized irrigation systems.
- Optimize the flow rates and rate of water advance in surface systems.
- Modify the irrigation timing and application rate.
- Develop and manage runoff recovery systems for one or more fields.
- Use expertise of private consultants who can evaluate and help develop irrigation systems.

Picture: Irrigation efficiency experts test the uniformity of a grower's irrigation system.

Growers are striving to manage irrigation and achieve practical and reasonable performance by irrigation systems they operate. The figures below show on-farm seasonal uniformity and irrigation efficiency from 936 field elevations.





Irrigation Training

Irrigation training conducted in both English and Spanish

Farmers, irrigators, and district staff also keep up with modern technology through training classes, workshops, short courses, and seminars available to them through the University of California Cooperative Extension, the Irrigation Training and Research Center (ITRC) located at the California Polytechnic State University in San Luis Obispo, and Fresno State University's Center for Irrigation Technology, in cooperation with the California Department of Water Resources. These institutions provide expertise related to irrigation, drainage, power consumption, water quality, and crop production. Farmers are exposed to irrigation principles and practices combined with a hands-on approach to irrigation management.

ITRC in Cal Poly features the John Merriam Irrigation Practices Field where a wide range of agricultural and landscape irrigation practices are demonstrated. A $1 million Water Delivery Facility provides a unique opportunity to examine pumps, canals, downstream and upstream control structured options, on site computerized gates to monitor/control water elevations and flows, and pipeline water delivery systems.

Irrigation Training Includes:

- AGWATER
- Canal automation
- Flexible water delivery systems
- Short courses/workshops
- Seminars
- Symposiums

Irrigation System Evaluations include:

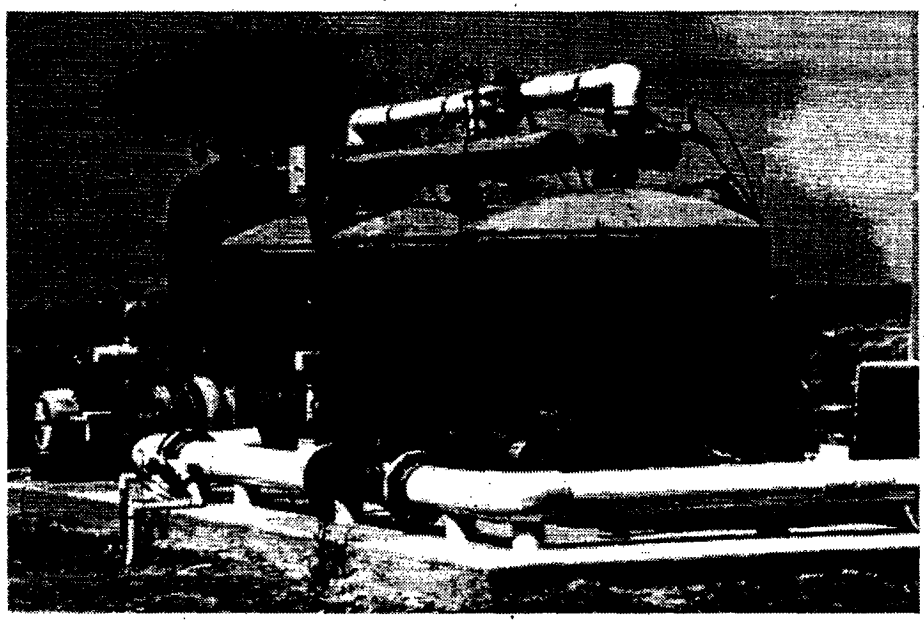
- Landscape water audits
- Basic landscape irrigation
- Training (English and Spanish)
- All agricultural irrigation methods

Agricultural Drainage Reduction

Farmers working toward sustainability of soil and plant environments in the San Joaquin Valley

A large portion of the westside of California's San Joaquin Valley has poor drainage. The soils in much of this area naturally contain elements, such as selenium, which are toxic at high concentrations. When water is applied to irrigate crops, drainage becomes contaminated with these elements. It is very difficult and expensive to safely treat and dispose of the contaminated drainage water.

Farmers found that one way to reduce the amount of contaminated drainage water is to carefully manage the amount of water being applied during irrigations. By working with farmers, DWR implements agricultural drainage demonstration projects in the San Joaquin Valley that are solution-oriented. Farmers are learning through state-of-the-art irrigation technologies and management techniques that offer cost-effective solutions for decreasing the volume of agricultural drainage that is produced. As a result, the costs for treatment and disposal of contaminated drainage water are being reduced.



Picture: A sand media filter is part of a drip irrigation system.

The Agricultural Drainage Reduction Demonstration and Study Projects include:

- Improved Furrow Irrigation Management
  (Irrigation evaluations, irrigation scheduling, use of sprinklers during pre-irrigation, tailwater return systems, and surge furrow irrigation)
- Emerging Irrigation Technologies
  (Subsurface drip irrigation, low energy precision application, and improved furrow irrigation)
- Implementation of a Tiered-Block Water Pricing Structure
- Irrigation Efficiency and Regional Subsurface Drainage Flow
- Increased Awareness of Water Use
- Studies on Irrigation Efficiency and Uniformity
- Studies on Contaminant Loads/Flows Relationship
- Studies on Quality and Quantity of Shallow Ground Water Inflow to the San Joaquin River
- Studies on Shallow Ground Water Management
- Studies on Agroforestry Systems for Sustainable Irrigated Land
- Irrigation Management Coordinator

As an example, the demonstration of Emerging Irrigation Technologies was conducted as an on-farm drainage reduction demonstration project on a 160-acre field, divided into 40-acre plots. The irrigation systems compared within the project were:

- Subsurface Drip—Irrigation tubing buried at 18 inches below the soil surface.
- LEPA—Low Energy Precision Application of water by a linear move system, with drop tubes that apply constant low flow inside furrows.
- Improved Furrow—Furrow irrigation with a tailwater recovery system and shortened furrow lengths with smooth soil surface to increase advance rate.
- Historic Furrow—Furrow irrigation as commonly used in the Westlands area.

After four irrigation seasons on cotton, the following results and recommendations were documented. These results will help San Joaquin Valley growers to irrigate more efficiently, and to effectively reduce on-farm deep percolation losses, therefore reducing agricultural drainage volume.

- Preirrigation and the first irrigation have the greatest potential to reduce the amount of agricultural drainage.
- Pressurized irrigation systems (drip and sprinkler) offer the flexibility and necessary control to significantly reduce excessive deep percolation to the shallow ground water table.
- Water conservation can be achieved from carefully designed and managed improved furrow irrigation systems.
- The subsurface drip plot received the least amount of applied irrigation water and consistently had the highest yields which compensates for the higher cost of the irrigation system.
- The ground water quality beneath the four 40-acre plots did not seem to change.
- The elevation of the ground water table beneath all plots declined due to no or minimal deep percolation.

DWR, based on the results of the emerging irrigation technologies demonstration, is concluding that:

- In this particular project, irrigation management and not the irrigation methods was the key to water conservation and drainage reduction.
- Growers exposed to this demonstration project have started to adopt new irrigation technologies to minimize their drainage outflows and maximize their long-term profitability.

Picture: Farm workers install subsurface drip irrigation system in a grower's field.

Additional activities that are making the difference...

California farmers and local agencies from around the State are using many innovative approaches to save water. Some of the current efficient water management practices will be explained briefly.

Picture: The LEPA irrigation system offers pinpoint precision of water application to the field.

• Growers in the Imperial Irrigation District implement, among other practices, tail water return systems at the field level to improve on-farm and district-wide efficiencies. The main objective of this practice is to reduce runoff water that would otherwise leave a field or a farm and go finally to the Salton Sea. This recovered water can be reused on the same field or a nearby field, thus increasing efficiency of water use. This practice has provided opportunity for IID to transfer some water for urban water use. However, reduced surface flows to the Salton Sea may have adverse impacts on water quality.

• Wide use of micro-irrigation systems in the Coachella Valley by growers of citrus and table grapes increases efficient irrigation management and crop yields. The main reasons growers adopt micro-irrigation for table grapes and citrus are good irrigation scheduling and a timely and accurate supply of nutrients "spoon fed" through irrigation water to these permanent crops. In addition, with drip irrigation in grapes, growers achieve a good irrigation distribution uniformity which results in uniform crop growth and uniform harvest. Through this type of irrigation system, growers often produce a much higher yield and better quality crop. In many areas growers can achieve early crop production as well, which brings premium prices. Growers in Coachella Valley have learned that use of such micro-irrigation systems is particularly suitable in that area since soils are predominantly sandy, and other surface irrigation systems may be less efficient.

Picture: Drip irrigation of grapes has helped growers achieve high irrigation distribution uniformity that has resulted in uniform crop growth and harvest.

- Both Coachella Valley Water District and Imperial Irrigation District have made canal lining a long standing practice and goal for it helps to reduce seepage and water losses. Both districts have implemented this practice according to their priorities and funding. In some areas canal lining should be done with much care and study with regard to economic feasibility and environmental effects. Not all seepage water is a true loss, since some plants and trees along unlined canals might survive on the seepage and provide a wide variety of wildlife habitats including beneficial insects.

- Canal interceptors and a regulating reservoir in the Imperial Irrigation District help reuse of surface runoff and drainage water. Several districts are developing annual water balances, including seepage losses and operational losses. In Broadview Water District a district-wide return flow system provides opportunity for reuse of surface runoff and drainage water. The practice of drainage water reuse should be considered with caution paying close attention to the salt buildup in the soil environment. Long-term sustainability of the soil environment and soil productivity requires maintenance of salt balance. Developing a district-wide water balance helps to identify opportunities for water conservation and drainage water management.

- Farmers in Tulare Lake Basin and other areas in the San Joaquin and Sacramento Valleys use laser leveling technology to improve furrow and border irrigation systems. In addition, level basins have been adopted to apply large flows on one end of the basin to obtain fast advance, achieving high distribution uniformity and at the same time less deep percolation losses. A precisely leveled field provides an ideal condition for the highest possible distribution uniformity and, thus, reduces losses.

- Orchards of almonds, citrus, walnuts, avocados, stone fruits, and grape vines are increasingly irrigated with drip, sprinklers, microsprinklers, and microsprayers. In the early 1970s, avocados became the first crop to be irrigated with drip. Drip replaced solid set sprinkler irrigation in the steep slopes of Northern San Diego County and was used in new avocado orchards in the same area. Later, drip became very popular in grape vines in the Coachella Valley, San Joaquin Valley, the Coastal Valleys, and Napa Valley. During the 1980s many almond orchards, walnuts, citrus, stone fruits, and pistachios were either converted to drip or micro-irrigation, or planted with this type of lowf low, localized, frequent irrigation system.

Drought, water supply shortages, and increases in both price of water and energy have prompted many California growers to adopt these new irrigation systems that have resulted in increased yield per unit of water applied, better crop quality, and overall profitability.

- A number of irrigation districts are increasingly adopting canal automation to improve water delivery systems. The ideal delivery system is one in which growers receive water on demand when needed and terminate irrigation without causing operational spills and losses. New hardwares and softwares are now available to implement both flexible water delivery and canal automation. Flexible water delivery or, ideally, on demand water delivery may be the single most important practice needed for good irrigation scheduling and efficient use of water. The Irrigation Training and Research Center at Cal Poly San Luis Obispo is conducting studies and workshops for irrigation district staff regarding flexible water delivery and canal automation.

Picture: Canal automation to improve water delivery allows growers to receive water on demand and terminate irrigation without causing operational spills and losses.

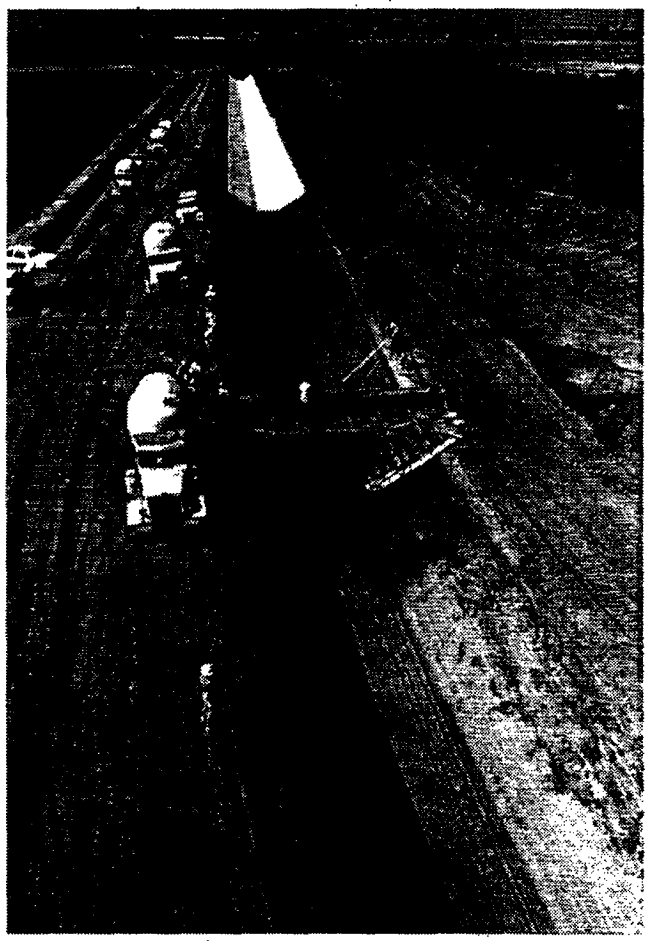
- Grasslands area irrigation districts provide their growers with low interest rate loan programs for pressurized irrigation systems. While some districts have used their own funds, others have received funds from the State. For example, the State Water Resources Control Board and the U. S. Environmental Protection Agency cost share with a low interest rate loan program for purchasing improved irrigation systems. The main goal of such a program is to improve water quality through increasing irrigation efficiency. Examples of irrigation districts implementing such programs are Central California Irrigation District, Broadview Water District, Firebaugh Canal Water District, and Panoche Drainage District.

- Growers and local agencies in the West Stanislaus area implement efficient water management practices, such as on-farm irrigation evaluation and improvements, to reduce sediment load and agricultural drainage/runoff flow to the San Joaquin River. Growers and local agencies are working together, with assistance from the State, to implement on-farm efficient water management practices such as on-farm irrigation evaluation, tailwater return systems, irrigation scheduling, education and workshops, and use of gated pipes and sprinkler irrigation to reduce sediments flowing into the San Joaquin River. Such efforts, while enhancing the local environment and water quality, have far reaching positive effects on the water quality issues in the Delta. These kinds of programs in other parts of the State do benefit water quality of surface water supplies as well as ground water supplies.

- Private sector irrigation consultants provide technical and management services and computer softwares to farmers throughout the State. Consultants have been one of the vital links between the water management findings of the Universities, State and federal researchers, and California farmers. Irrigation consultants provide on-farm technical assistance in scheduling irrigations, evaluating irrigation systems, recommending improvements, and designing irrigation system layouts. Consultants also have developed, marketed, and supported irrigation management softwares for irrigation scheduling, irrigation system design, and water delivery record keeping. They also supply specialized support for the operation of new and sophisticated irrigation equipment such as automated micro-irrigation and linear move sprinkle irrigation systems.

DWR has contracted with several consultants to conduct on-farm demonstration and study projects and provide technical reports. DWR does not

endorse individual consultants or firms, nor does it endorse any software developed by public or private entities. However to help growers and others in need of assistance, a list of a few of the softwares on the market and a list of names of consulting firms offering technical irrigation services can be accessed through the CIMIS system. This list includes only consultants who have requested to be included on the CIMIS data base and does not include all available consultants. A complete list of certified consultants and irrigation designers is available from the Irrigation Association.



Picture: Canal lining helps to reduce seepage and water losses.

• Growers in the Westlands Water District use their District's irrigation scheduling guide and water management handbook, and services to improve irrigation practices. The District's irrigation specialists provide technical assistance to the growers in meeting their needs regarding irrigation scheduling and irrigation water management in general. In addition, the District co-funded projects with DWR to improve water management and reduce drainage such as irrigation system evaluations and irrigation scheduling through private consultants. Growers within Westlands Water District have adopted improved furrow irrigation, using shorter furrow runs, gated pipes, tail water reuse systems, and sprinkler irrigation during pre-irrigation.

• Many growers are using fee-for-service expertise of private consultants for irrigation system design, irrigation scheduling, fertilization, pest control, and other cultural practices. Corporate farming operations may have in-house irrigation scheduling services. However, in most cases private agricultural consultants provide this type of service. Irrigation system designs are provided by irrigation dealers and/or irrigation specialists who provide independent design and a list of materials with specifications and installation instructions. DWR, the California Energy Commission, and the Irrigation Association provide irrigation design classes in cooperation with universities and irrigation equipment manufacturers. Some manufacturers train their own dealers in the area of irrigation system design. The private sector has played a very important role in selling irrigation equipment, design services, and management services to the growers.

• Growers directly access CIMIS and use real time reference evapotranspiration data (ETo) to schedule their irrigations. Information about crop coefficients and the water-holding capacity of their soils is available from many sources such as the U.C. Cooperative Extension. Over 2,100 direct users, and many more indirect users access CIMIS information. In 1993 and 1994, over 22,700 direct calls were made each year to DWR's CIMIS computer alone. Other tools available to growers are the Mobile Irrigation Management Laboratories (Mobile Labs), managed by irrigation specialists who conduct irrigation system evaluations at the field level for any type of system in California.

• The Central California Irrigation District offers incentives to its growers to promote lining of existing service laterals and ditches. Growers are

using the District's low interest water conservation loan funds to eliminate seepage and improve water service by eliminating obstructions to water flow such as weed growth typical of earth channels. Other types of projects such as installation of tail water return systems and microdrip irrigation systems are also funded by the program. The District estimates that over 1,600 acre-feet of water per year has been conserved since the program began in 1990.

- Rice growers in the Sacramento Valley widely reuse surface runoff, both at the farm and at the district level. This practice helps reduce applied water to the field, reduce runoff, and enhance water quality in the Sacramento River. Rice growers have been able to reduce pesticide contamination of the Sacramento River using this practice and others. In addition, rice growers are laser leveling their fields, and are using shorter rice varieties. These last two factors are allowing growers to reduce the amount of water diverted and used to grow rice, and at the same time increasing the yield and quality of rice.

- Irrigation systems such as gated pipes, hand move sprinklers, surface and sub-surface drip irrigation, and linear move sprinklers are increasingly used in the areas with shallow ground water problems. Growers understand that controlling the amount of water applied and achieving high distribution uniformity can reduce deep percolation losses. These irrigation systems potentially can operate in a high range of distribution uniformity, called emission uniformity in the case of drip irrigation, if properly managed and maintained. Farmers, who are also discerning business people, adopt more precise irrigation methods not only to save water and/or reduce drainage but to increase yields and/or quality of their crops. Consequently, they have a better opportunity to increase their profits even with the additional cost of an important capital outlay for a new or improved irrigation system.

- Sprinkler systems are used for pre-irrigation, instead of flood irrigation, to reduce deep percolation losses, and improve distribution uniformity and irrigation efficiency. Pre-irrigation is an irrigation practice that has been recommended in the San Joaquin Valley for many years by the University of California's Cooperative Extension. The reason behind this practice is the low rainfall during the winter months, and the need to refill the soil moisture in the root-zone after it has been depleted by the previous crop. The soil moisture is then stored through the beginning of the

irrigation season and is available for the crop during the peak evapotranspiration of hot summer months.

- Soil moisture and plant water stress monitoring using tensiometers, gypsum blocks, neutron probes, pressure bombs, infrared thermometry, and other methods are among the tools that growers use for efficient irrigations. The irrigation industry has produced many soil moisture, soil tension, and plant stress measurement devices that have also been tried during irrigation research projects by the universities. California farmers have used different types of devices to monitor soil moisture/tension in their orchards, grape vines, and many of their row crops and vegetables. In most cases these devices can tell when it is time to irrigate, but few of them can give a good answer to the question: How much water should I apply? For this reason California farmers are using CIMIS in growing numbers (see page 1 of this brochure), in addition to using soil moisture monitoring devices. CIMIS has become a valuable tool for improving irrigation scheduling.

Picture: Soil moisture monitoring devices have become a valuable tool for irrigation scheduling.

- Irrigation specialists of the University of California's Cooperative Extension, in cooperation with growers, have conducted applied research and other studies to:

  - Determine crop coefficients.
  - Monitor crop yield and water use using CIMIS .
  - Monitor surge irrigation in furrows.
  - Reuse tail water in rice fields.
  - Determine variability in soil intake rates to improve on-farm. irrigation efficiency in California.
  - Assess micro-irrigation system performance.
  - Regulate deficit irrigation in fruit trees and nut crops.
  - Develop drought irrigation strategies.

The University of California's Cooperative Extension has played a key role in researching and demonstrating modern irrigation technology, taking into consideration soil physical characteristics, crop evapotranspiration and crop productivity at each particular climatic environment where the research projects have been conducted. Farm advisors specialized in irrigation and crop production have been available to explain to growers how to improve irrigation efficiency without impacting soil productivity and how to reduce the impact of irrigated agriculture on water quality in general.

California growers have been able to adopt the latest irrigation technologies with confidence since the U.C. Cooperative Extension, Center for Irrigation Technology at Fresno State University, Irrigation Training and Research Center at California Polytechnic Institute, and other educational institutions have provided technical information about the performance, adaptability to California conditions, and economic feasibility of many irrigation technologies available today in the world market.

- Kern County Water Agency, Arvin-Edison Water Storage District, Coachella Water District, and many other agricultural water suppliers have developed ground water recharge basins. In wet years when there is excess water, such as the winter of 1995, they recharge ground water. In dry years, they can use this stored water as ground water supply. This practice is known as conjunctive use of surface and ground water. Other districts in the San Joaquin and Sacramento Valleys divert flood water supply that is available, instead of pumping ground water for irrigation in

early Spring. This practice is known as "in lieu" recharge. In many areas, canal seepage and even water losses from irrigated fields that go to usable ground water is considered recharge of the aquifer, particularly in wet years. This form of recharge may be intentional or incidental. In dry years, in the same areas, irrigation practices are and can be changed to minimize deep percolation and recharge. Growers using more of the ground water and diverting less of surface water, can therefore benefit the environment by leaving more water in river and stream systems.

- Irrigated agriculture and municipal water users in the coastal valleys both in Central and Southern California are facing the challenge of sea water intrusion and ground water degradation due to salinity build up and the leaching of nitrogen into the aquifer. Ground water pumping is the main water supply for agricultural, urban, and industrial water use. As a result, overdraft has become a problem. Water agencies are promoting metering of all wells and implementing on-farm efficient water management practices. Growers in Salinas Valley, Santa Maria Valley, Santa Barbara, Ventura, Oxnard, San Diego, and other areas are sponsoring and using Mobile Labs, CIMIS stations, and consultant services to improve their irrigation efficiency and irrigation scheduling, among many other practices. DWR contributed to initiate those programs. Water agencies, U.C. Cooperative Extension, USDA's Natural Resources Conservation Services, and Resource Conservation Districts are increasingly working together in a coordinated effort to mitigate the overdraft and reduce the ground water contamination in the coastal valleys, as well as preventing further seawater intrusion.

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